

Investigation Report – PG & E Concrete Driveway and Garage – Weight Load Failure
March 11, 2016 – April 17, 2017

Lead Investigator **Matthew T. Kisak, P.E.**
Consultant **R Sinclair Group, LLC**
Date of Report **08/10/2019**
Subject **Concrete e Driveway and Garage – Weight Load Failure**

Operation, Location, and Consequences

Estimated Date of Failure **03/11/2016 – April 17, 2017**
Product Failure **Concrete Driveway and Garage Floor (Structural)**
Reason **Heavy Equipment/Excessive Weight Caused Failure**
City, County & State **Oakland Alameda, California**
Operators Name **Pacific Gas and Electric (PG&E)**
 230 Market Street
 San Francisco, CA 94607
Other Agency **USA – Emergency Utility Location Service**
Response Time **N/A**
Work Order No. **N/A**
Time Acknowledged **N/A**
Location **2845 Magnolia Street, Oakland, CA**

Type of Failure **Concrete Cracks and Fracture's (Excessive Load Bearing)**
Fatalities **0**
Injuries **0**
Description of area **Residential Dwelling (3 Bedroom Dwelling)**
Property Damage **\$30,877**

Executive Summary

Thereof March 2017, PG & E (hereafter “Operator”) and Roadway Construction, Inc. (hereafter “Contractor”) appeared to have caused sizable cracks and failure to 7 to 4 inch thick, fibermesh reinforced 3500 PSI “Concrete Driveway” by operating “Heavy Equipment” and “Excessive Vibrations” which appeared to have caused like damage to “Concrete Garage” floor at 2845 Magnolia Street Oakland, CA. In addition to these damages Operator’s Contractor also saw cute “Concrete Driveway” near the entrance (south side) and replaced it with black top asphalt (an inferior material). Analysis determined the probable cause of failure to be excessive load bearing . It is of note that on September 6, 2017, Mr. & Mrs. Green (hereafter, “Green’s” or “Property Owner”) requested information from the Operator pertaining to this incident in accordance with the “Public Information Request Act”. The Operator did not respond in a timely manner to this request and upon response provided partial documentation with the stipulation that select information was withheld per stipulations of the “Public Information Request Act”. Therefore, the Operator has inferred that additional documentation to this event is in their possession with bias. Should these proceedings advance to litigation such documentation will be recovered during discovery. It was noted that according to Operator’s records the Gas Pipeline Replacement Program (GPRP) was under the oversight of Ms. Vitaly Tyurin, East Bay Division Manager. On April 17, 2017 Ms. Tyurin informed the Green’s if they had issues concerning safety, etc. to contact the local representative Rosanne Cruz. Property Owner has stated that Heavy Equipment was operated in close proximity to luxury automobiles and may have caused damage to surface and undercarriage.

System Description

The Operator’s website (Customer Service) has acknowledged the standard operating procedures for the Gas Pipeline Replacement Program (GPRP):

The GPRP will accentually replace gas pipelines in the street and pipelines that run from the main into various buildings and homes. The GPRP may also require the relocation of gas meters.

Operator’s website states: *This work is part of our extensive Gas Pipeline Replacement Program to improve gas service to our customers. We are replacing them with modern new piping that is more resistant to corrosion and earth movement. Our goal is to have a more reliable system with less maintenance and lower energy costs. The relocation of some gas meters may be required under current California Public Utilities Commission (CPUC) requirements and or local codes and ordinances and is based on today’s safety considerations.*

This project allows PG&E to meet a commitment to our customers to provide safe, reliable service. The Gas Pipeline Replacement Program (GPRP) is by agreement between our company and the CPUC. The pipe replacement priorities are based on age and pipe leakage history, so the highest priority pipe will be replaced first.

The GPRP is scheduled to be completed by means of three phases of operation stated in detail on Operators website. In particular Phase 2 states “Heavy equipment is necessary to facilitate this work”. It is questionable if Operator fulfilled its commitment to the community (based on comments made by neighbors to the Greens) and property owner during this phase of the GPRP.

Incident Description

PG & E's Contractor damaged Concrete Driveway and surrounding property during installation of gas pipeline and road work for the Gas Pipeline Replacement Program (GPRP). The incident occurred on or about March 11, 2016 thru April 17, 2017. The location of the incident in question is 2845 Magnolia Street, Oakland, CA 94605, which is a Multi Family Structure Built in 1982, with two one story dwellings, which sits on a 7,261square foot lot and features 4 bedrooms and4 bathrooms. According to City records this property was built in 1982, with an additional unit built in 2005. Based on RSG's initial site visit, review of documents, and professional evaluation by Mr. Matthew T. Kisk, P.E. (Civil), it is our conclusion that the aforementioned activities related to GPRP caused the incident attended to by Operator's Contractor performing demolition, excavation, pipe installation, import/ export of material, etc. The incident in question was documented to be the cause of the Operator's Contract use of heavy equipment on and in close proximity to the above-referenced property and therefore potentially caused sub terrain instability to the surrounding area, with the possibility of causing excessive vibrations, which may have caused subterranean destabilization and structural failure, thus impacting structural integrity.

Operating Conditions Prior to Incident

Prior to March 11, 2016, the incident the property and structure had no historical or discernable sizable cracks or failure. Time stamp photograph confirm this statement. Cracks and failure were not detected prior to Operator's Contractor construction activities related to GPRP. Based on standard engineering practices it is our assessment that normal passenger vehicle usage would not cause server damage to 7 to 4-inch-thick, fibermesh reinforced 3500 PSI "Concrete Driveway/Slab". Review of dated photographs and security system recordings conclusively confirm condition of property prior to GPRP activities.

Investigation and Operating Conditions after the Incident

On March 11, 2016 PG & E responded to property owner's complaint pertaining to what is now known to be structural concrete failure at the incident site due to operation of heavy equipment on property driveway and surrounding area. It is assumed that these factors caused damage to the property in question. During the investigation, we assumed the Operator was made aware of these incidents by the Contractor under contract for this phase of the scope of work. Obviously, due to these factors the Operator implementation of the GPRP has caused the property owner to incur damages, cost and inconvenience. The property has lost value due to these events and the integrity of the of the structure's components are questionable due to these factors.

Concrete Analysis

Concrete failure analysis is the process by which an engineer determines the mechanism that has caused a material component to fail. Typical failure modes involve various types of deterioration and mechanical damage. Concrete components fail as a result of the environmental conditions to which they are exposed, as well as the mechanical stresses they experience. Often a combination of both environmental conditions and stress will cause failure. A Concrete failure analysis takes into account as much of this information as possible during analysis. The final goal of failure analysis is to provide a determination of the root cause and a solution to any underlying problems to prevent future failures. Non-Destructive Testing (NDT) is generally used to detect failures in components before the component fails catastrophically. Standard failure modes which can lead to distinct Concrete failure mechanisms are accepted by ASTM, ASM and NACE. We mention

these factors due to the nature of the incident under consideration and the Operators admittance to heavy construction equipment usage in the proximity of the property and confirmation by dated photographs and the property owner's security surveillance system.

The following data is based on Federal Highway Administration standards. The Operator's Contractor used heavy equipment that PSI strength that may have been that of a fully loaded Semi-truck and Trailer. That being the case, it takes some mathematical formulas for weight distribution, and the numbers will vary slightly as the weight is not perfectly distributed to each wheel, but we can approximate, and know it will be thereof 5,000 PSI Exterior concrete, poured to a thickness of at minimal 6 inches, at 6 inches it may crack. To conclude this scenario 3 calculations were used:

1. First the surface area of each test wheel was determined: for math purposes the test simulation used simple numbers: 12" wide wheel and 6" thickness is touching the ground. $12" \times 6" = 1 \times .5 = .5$ SF touching ground, times 18 wheels = 9 SF touching the ground.
2. 9 SF divided by 90,000 pounds = 10,000 pounds per square foot
3. 10,000 pounds divided by 12 inches = 833 psi, pounds per square inch pressing down (seems like 5,000 PSI would cover it)

Given an average tractor trailer truck, with 18 large wheels, on reinforced concrete placed on a good, dense, solid subgrade, 6 inches of concrete would hold the distributed load easily. Put the same load and concrete on 4 inches of concrete, and the slab would likely fail. To highlight this, point the failure was caused to 7 to 4-inch-thick, fibermesh reinforced 3500 PSI "Slab".

These calculations emphasis that the load bearing/stress factors described above are sufficient to establish failure due to Operator's Contractor usage of the Green's driveway as turnabout for the convenience of their equipment and construction activities. This allowed the Operator's Contractor to complete scope of work in a more expedited manner. Other equipment such as Construction Pavement Roller which typically weighs between 0.9 and 18 tons was also used.

Geotechnical – Vibration Analysis

Geotechnical analysis is the process by which a geologist conducts a technical analysis of the soil conditions surrounding and upon which a structure is located to determine soil properties on the site. Each construction or industrial site is different, and vibration mitigation measures should be correctly applied at each site. It is important to set performance criteria relating to vibrations and movement of surrounding buildings. Specifications for the control of construction vibrations should be prepared for major building projects. Harmful soil movements and structural damage from vibrations generated by construction and industrial sources can be prevented in most cases, Dowding (1996), Woods (1997), Svinkin (2004, 2005b). SOURCES OF CONSTRUCTION AND INDUSTRIAL VIBRATIONS

Based on these assumptions and structural failures it is evident that Specifications for the control of construction vibrations was not successfully implemented as part of GPRP. Based on this analysis sub terrain settlement due to subsurface vibrations caused by heavy equipment activities

cause failure to the driveway/garage slab area and upon further investigation we expect analytical data will yield conclusive evidence of damage to the principle structure.

Findings

1. The “7 to 4 inches” Damaged Concrete Driveway and Slab failure was due to excessive weight and vibrations.
2. These factors were caused by heavy equipment being operated on and in proximity of property.
3. Non – compliance to industry standards pertaining to weight load bearing.
4. Construction crew seemed to operate with minimal or inferior supervision.
5. At the time of the discovery, the Operator’s Contractor denied obvious damage to property.
6. Based on Operator’s documentation, the property owners were to be made aware of project activities and change to scope of work.
7. The Operator only provided partial documentation of the incident per stipulations of the “Public Information Request Act”.
8. It is conceivable that a lack of proper training and procedures implementation led to the recorded and conceivably future structural failures, etc.
9. The Operator has acknowledged that it’s goal to complete the GPRP on or within predetermined schedule deadlines was the determining factor driving the completion date and is therefore susceptible to producing system related failure.
10. Weather conditions were a non-factor in determining incident conclusions.

Conclusions

1. After analysis and review of related activity it was determined that Operator’s schedule of construction work was the probable cause of the Damaged Concrete failure.
2. Due to the Operator’s lack of monitoring and oversight the response time to actions is deemed unresponsive due to resulted time lapse between initial discovery and the response to reporting by property owner. It is thereafter, our opinion that said dwelling may continue to experience foundation and structural integrity issues in the form of water intrusion, raised flooring, improperly functioning doors and windows, Concrete cracks and ground fissures as a result of the incident.
3. Remedial measures are recommended to address and correct sub terrain erosion, driveway, slab, foundation and structural failures. It is advised that these activities commence as soon as possible due to unknown geological factors.

Appendices

Appendix A – Photographs

Appendix B – Property Owner Statement







